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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
LIU, LI	
ART UNIT	**PAPER NUMBER**
2613	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/28/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)
	10/648,661	LEE ET AL.
	Examiner	Art Unit
	Li Liu	2613

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01/04/2007, Amendment*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *5/21/04,6/30/06,1/22/07*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments files on January 3, 2006 with respect to claims 1 and 5 have been fully considered but they are not persuasive. The examiner has thoroughly reviewed Applicant's amendment and arguments but firmly believes that the cited reference reasonably and properly meet the claimed limitation as rejected.

Applicant's argument – "neither Kim nor any of the other references cited by the instant Office Action suggest or teach that an optical band pass filter coupled to receive the output of the light intensity modulator to generate a duo-binary optical signal."

Examiner's response – As disclosed by the applicant, the MZ intensity modulator is used as the phase modulator (page 7, line 13-14). And the Figure 3 and Figure 4 shows "A bit of 0 or 1 is optically outputted at the **same magnitude without a change in intensity**. However, the bit of 0 or 1 is **converted into phase information** having a phase difference of 0 or π during modulation in an electrical field c". As admitted by the applicant, "Kim's duobinary transmission system provides that the **intensity** of the outputted signal of the phase modulator is **constant** whereas only the phase information is modulated." It is obvious that the phase modulator of Kim and the intensity modulator which is used as phase modulator perform the same functions.

Also, the cited prior Miyamoto et al (US 2003/0002121) teaches that an optical band pass filter (the Optical Filter Unit 5 in Figure 2) can be coupled to receive the output of the light intensity modulator (the intensity modulator used as a phase

modulating unit 3 in Figure 2, page 6, [0037], [0096], [0106]), so to generate a duo-binary optical signal ([0029], [0106], and [0119]-[0124]).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 2, 4-9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyamoto et al (US 6,865,348, hereinafter US '348) in view of Miyamoto et al (US 2003/0002121, hereinafter US '121) and Kim et al (Kim et al, "Demonstration of Optical Duobinary Transmission System Using Phase Modulator and Optical Filter", *IEEE Photonics Technology Letters*, Vol. 14, No. 7, page 1010-1012, July 2002).

1). With regard to claim 1, Miyamoto et al (US '348) discloses a duo-binary optical transmission apparatus (170 in Figure 23A), comprising:

a light source for outputting a light carrier (175 in Figure 23A);

an optical modulator (174 in Figure 23A) for modulating the light carrier according to a 2-level data signal (Figure 23A, binary signal as input, column 24, line 21-27);

the optical modulator (174 in Figure 23A) comprises:

a code converter (171 in Figure 23A) for converting the 2-level data signal into a duo-binary signal (the DUOBINARY ENCODED SIGNAL output from 171);

a driving signal generator (173 in Figure 23A) for receiving the duo-binary signal and generating a modulator driving signal;

a light intensity modulator (174 in Figure 23A, column 24 line 19-20), for receiving the modulator driving signal, and for outputting a modulated optical signal (column 24 line 16-27);

Miyamoto et al (US '348) discloses that the light modulator generates an optical duobinary encoded signal (column 24 line 25-27) and a "band dividing section" is used at the receiver (120 in Figure 24A). But Miyamoto et al (US '348) does not explicitly teach that (A) the light intensity modulator is for converting a phase of the light carrier, and (B) an optical band pass filter for receiving the modulated optical signal from the light intensity modulator, for filtering the modulated optical signal to be suitable for a predetermined band, and for outputting a duo-binary optical signal; and (C) a wide band pass filter having a bit ratio of 0.7/T.

With regard to item (A) and (B), Miyamoto et al (US '121) discloses a system in which a duobinary signal can be generated and the MZ optical intensity modulator is used as the phase modulating device (Figures 1 and 2, and [0037] and [0095]). And the phase of the light carrier is converted by the MZ modulator (Figures 3 and 4, [0030]). And Miyamoto et al (US '121) teaches that an optical band pass filter (the Optical Filter Unit 5 in Figure 2) coupled to receive the output of the light intensity modulator (the intensity modulator used as a phase modulating unit 3 in Figure 2, page 6, [0037], [0096], [0106]), to generate a duo-binary optical signal ([0029], [0106], and [0119]-[0124]).

It is well known that the MZ optical intensity modulator can be used as the phase modulator because of its simple structure and low cost. Also as a phase modulator, it does not require a dual-drive MZ modulator. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the phase modulating device taught by Miyamoto et al (US '121) et al to the apparatus of Miyamoto et al (US '348) so that the cost of the system can be reduced, and the symmetry requirement of the modulator can be eliminated if a X-cut modulator is used.

With regard to item (B) and (C), Kim et al, in the same field of endeavor, discloses an optical duobinary transmission system in which an optical phase modulator and an optical filter (Figure 1, INTRODUCTION) have been used for generate duobinary signal.

As disclosed by Kim et al, the conventional duobinary generator has some drawback: the system performance greatly depend on the word length since the three-level signal can experience distortions depending on the imperfect response of the Low Pass Filter (LPF) etc. The optical phase modulator with an optical band pass filter will overcome the problems associated with world lengths (page 1010, INTRODUCTION). Kim et al also disclose a widel band pass filter having a bandwidth 0.7/T (1/T is the bit rate of the NRZ data). In Kim et al's system, a 10 Gb/s NRZ PRBS is used and simulation shows a optimum bandwidth is around 7 GHz, that is 0.7*BitRate, and the experiment used the optical band filter 7 GHz (Figure 5 page 1011 right column).

The narrow spectral width is the most important feature of the duobinary signal in achieving high-spectral-efficient and large dispersion tolerance DWDM systems. It is

essential to bandlimit the optical duobinary signal. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the the optical filter as taught by Kim et al to the system of Miyamoto et al (US '348) and Miyamoto et al (US '121) et al so that the problem associated with word length is overcome, and the spectra of the optical signal is limited and the interference between different channels as well as the nonlinear interaction can be reduced, and the receiver sensitivity is improved.

2). With regard to claim 2, Miyamoto et al (US '348) and Miyamoto et al (US '121) and Kim et al disclose all of the subject matter as applied to claim 1 above. Miyamoto et al (US '348) further discloses wherein the light intensity modulator is a Z-cut dual armed light intensity modulator (MZ 174 in Figure 23A is a dual-electrode MZ intensity modulator, column 24 line 19-20).

3). With regard to claim 4, Miyamoto et al (US '348) and Miyamoto et al (US '121) and Kim et al disclose all of the subject matter as applied to claim 1 above. But Miyamoto et al (US '348) and Miyamoto et al (US '121) do not disclose wherein the characteristic of the output signal of the wide band pass filter is varied according to a bandwidth of the wide band pass filter.

However, Kim et al teaches that the best performance of the phase modulator duobinary signal can be achieved by optimizing the bandwidth of optical filter and the modulation depth of the phase modulator (page 1011, left column, and Figure 5).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the bandwidth optimization taught by Kim et al to

the apparatus of Miyamoto et al so to get optimal bandwidth of the bandpass filter, improve the system performance, and reduce the transmission penalty.

4). With regard to claims 5 and 11, Miyamoto et al (US '348) disclose a duo-binary optical transmission apparatus (170 in Figure 23A), comprising:

a duo-binary precoder (171 in Figure 23A) for encoding a 2-level data signal;

a pair of driving amplifiers (amplitude control units 173-1 and 173-2 in Figure 23A) coupled to receive the output of the duo-binary precoder;

a laser light source (175 in Figure 23A) for outputting a light carrier;

a light intensity modulator (174 in Figure 23A) for modulating the light carrier according to the 2-level data signal (column 24 line 16-27);

Miyamoto et al (US '348) discloses a "band dividing section" at receiver (120 in Figure 24A). But Miyamoto et al (US '348) fails to teach a wide band pass filter coupled to receive the output of the light intensity modulator to generate a duo-binary optical signal; wherein the light modulator is further operative to convert a phase of the light carrier (claim 11).

However, Miyamoto et al (US '121) discloses a system in which a duobinary signal can be generated and the MZ optical intensity modulator is used as the phase modulating device (Figures 1 and 2, and [0037] and [0095]). And the phase of the light carrier is converted by the MZ modulator (Figures 3 and 4, [0030]). And Miyamoto et al (US '121) teaches that an optical band pass filter (the Optical Filter Unit 5 in Figure 2) coupled to receive the output of the light intensity modulator (the intensity modulator

used as a phase modulating unit 3 in Figure 2, page 6, [0037], [0096], [0106]), to generate a duo-binary optical signal ([0029], [0106], and [0119]-[0124]).

It is well known that the MZ optical intensity modulator can be used as the phase modulator because of its simple structure and low cost. Also as a phase modulator, it does not require a dual-drive MZ modulator. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the phase modulating device taught by Miyamoto et al (US '121) et al to the apparatus of Miyamoto et al (US '348) so that the cost of the system can be reduced, and the symmetry requirement of the modulator can be eliminated if a X-cut modulator is used.

And another prior art, Kim et al, in the same field of endeavor, discloses an optical duobinary transmission system in which an optical phase modulator and an optical filter (Figure 1, INTRODUCTION) have been used for generate duobinary signal.

As disclosed by Kim et al, the conventional duobinary generator has some drawback: the system performance greatly depend on the word length since the three-level signal can experience distortions depending on the imperfect response of the Low Pass Filter (LPF) etc. The optical phase modulator with an optical band pass filter will overcome the problems associated with world lengths (page 1010, INTRODUCTION). And the narrow spectral width is the most important feature of the duobinary signal in achieving high-spectral-efficient DWDM systems. Kim et al teaches to use an optical filter. It would have been obvious to one of ordinary skill in the art at the time the invention was made to add the optical filter taught by Kim et al to the apparatus of Miyamoto et al so that the problems associated with world lengths can be overcome by

using an optical phase modulator with an optical band pass filter, and the spectra of the optical signal is limited and the interference between different channels as well as the nonlinear interaction can be reduced.

5). With regard to claim 6, Miyamoto et al (US '348) and Miyamoto et al (US '121) and Kim et al disclose all of the subject matter as applied to claim 5 above. But Miyamoto et al (US '348) does not teach wherein the characteristics of the duo-binary optical signal are varied by controlling an applied voltage and a bandwidth of the wide band pass filter.

However, Kim et al teaches that the best performance of the phase modulator duobinary signal can be achieved by optimizing the modulation depth (the driving voltage) of the phase modulator and the bandwidth of optical filter (page 1011, left column, and Figure 5).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the adjustable driving voltage and the bandwidth optimization taught by Kim et al to the apparatus of Miyamoto et al so to get the best system performance and reduce the transmission penalty.

6). With regard to claim 7, Miyamoto et al (US '348) and Miyamoto et al (US '121) and Kim et al disclose all of the subject matter as applied in claim 5 above. But Miyamoto et.al (US '348) does not teach wherein the wide band pass filter is further operative to filter the modulated light signal to be suitable for a predetermined band.

However, Kim et al teaches that the best performance of the phase modulator duobinary signal can be achieved by optimizing the bandwidth of optical filter and the modulation depth of the phase modulator (page 1011 left column, and Figure 5).

It is well known that the narrow spectral width is the most important feature of the duobinary signal in achieving high-spectral-efficient DWDM systems. Kim et al demonstrates that the optical bandpass filter installed after the MZ can get the same results as the conventional electrical low pass filter installed just after the duobinary precoder (Figure 2 and 3, page 1011, left column), and the optical bandpass filter is operative to filter the modulated light signal to be suitable for a predetermined band (Figure 3 and 5).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the optical bandpass filter taught by Kim et al to the apparatus of Miyamoto et al so to get the required band of signal, reduce interference between different channels as well as the nonlinear interaction, and improve the system performance and the receiver sensitivity.

7). With regard to claim 8, Miyamoto (US '348) and Miyamoto et al (US '121) and Kim et al disclose all of the subject matter as applied in claim 5 above. And Miyamoto et al (US '348) further discloses that wherein the pair of driving amplifiers (173-1 and 173-2 in Figure 23A) is configured to apply 3-level signals to the light intensity modulator (column 24 line 21-27).

8). With regard to claim 9, Miyamoto (US '348) and Miyamoto et al (US '121) and Kim et al disclose all of the subject matter as applied in claim 5 above. And Miyamoto et

al (US '348) further discloses wherein the light intensity modulator is a Z-cut dual armed light intensity modulator (MZ 174 in Figure 23A is a dual-electrode MZ intensity modulator, column 24 line 19-20).

4. Claims 3 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyamoto et al (US 6,865,348, hereinafter US '348) and Miyamoto et al (US 2003/0002121, hereinafter US '121) and Kim et al (Kim et al, "Demonstration of Optical Duobinary Transmission System Using Phase Modulator and Optical Filter", *IEEE Photonics Technology Letters*, Vol. 14, No. 7, page 1010-1012, July 2002) as applied in claims 1 and 5 above, and further in view of Hirano et al (US 2003/0002112).

Miyamoto et al (US '348), Miyamoto et al (US '121) and Kim et al disclose all of the subject matter as applied to claim 1 above. But Miyamoto et al (US '348) and Miyamoto et al (US '121) and Kim et al fail to disclose wherein the light intensity modulator is an X-cut dual armed light intensity modulator.

However, Hirano et al teaches the X-cut dual armed light intensity modulator ([0068]), and discloses that if an X-cut structure is employed it is possible to achieve chirp free modulation using only one electrode.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the X-cut structured MZ modulator taught by Hirano et al to the apparatus of Miyamoto et al (US '348), Miyamoto et al (US '121) and Kim et al so that the need for any synchronization between two driving signals as in Z-cut modulator is eliminated, and the requirements on the driver amplifiers is considerably alleviated.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Yonenaga et al (US 2002/0033984) disclose an optical transmission system, and Z-cut and Y cut Lithium-Niobate MZ modulators are used to generating duobinary signals.

Royset et al (Royset et al: "Novel Dispersion Tolerant Optical Duobinary Transmitter Using Phase Modulator And Bragg Grating Filter", ECOC'98, September 20-24 1998, page 225-226, Madrid, Spain).

Winzer et al (Winzer et al: "Return-to-Zero Modulator Using a Single NRZ Drive Signal and an Optical Delay Interferometer", IEEE Photonics Technology Letters, Vol. 13, No. 12 December 2001, page 1298-1300) disclose a system with a phase modulator which can generate a DCS-RZ.

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Li Liu whose telephone number is (571)270-1084. The examiner can normally be reached on Mon-Fri, 8:00 am - 5:30 pm, alternating Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Li Liu
February 21, 2007

KENNETH VANDERPUYE
SUPERVISORY PATENT EXAMINER